

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of forming an optical waveguide, the method comprising:

flowing a silicon source gas into a process chamber;

flowing an oxygen source gas into the process chamber;

forming a high-density plasma in the process chamber from the silicon source gas and the oxygen source gas;

forming a plurality of separated ~~high contrast~~ silicate glass optical cores over an undercladding layer disposed within the process chamber with the high-density plasma, the separated ~~high contrast~~ silicate glass optical cores defining a sequence of gaps; and

depositing an uppercladding layer over the plurality of separated ~~high contrast~~ silicate glass optical cores,

wherein each of the ~~high contrast~~ silicate glass optical cores is formed with a refractive index greater than a refractive index of the undercladding layer <u>such that each of the optical cores has a contrast relative to the undercladding layer greater than 2%</u>.

2. (Previously Presented) The method of claim 1 further comprising maintaining a pressure within the process chamber less than 100 millitorr while forming the silicate glass optical cores, wherein forming the high-density plasma comprises providing energy to the process chamber inductively with an RF power density greater than 3 $Watts/cm^2$.

3. (Currently Amended) The method of claim 2 further comprising flowing a nitrogen source gas into the process chamber, wherein forming the high-density plasma comprises forming the high-density plasma from the silicon source gas, the oxygen source gas, and the nitrogen sources gas, whereby the plurality of ~~high contrast~~ optical cores comprise~~s~~ silicon, oxygen, and nitrogen.

4. (Original) The method of claim 3 wherein the nitrogen source gas is molecular nitrogen.

5. (Canceled).

6. (Previously Presented) The method of claim 3 wherein the oxygen source gas and silicon source gas are flowed to provide a ratio of oxygen atoms to silicon atoms in the high-density plasma greater than 3:1.

7. (Previously Presented) The method of claim 3 wherein the silicon source gas comprises silane, the oxygen source gas comprises molecular oxygen, and the nitrogen source gas comprises molecular nitrogen.

8. (Previously Presented) The method of claim 7 wherein the molecular oxygen is flowed into the process chamber at a rate greater than 1.5 times a rate at which the silane is flowed into the process chamber.

9. (Previously Presented) The method of claim 7 wherein the molecular oxygen is flowed into the process chamber at a rate between 200 and 600 sccm.

10. (Previously Presented) The method of claim 7 wherein the molecular nitrogen is flowed into the process chamber at a rate between 0.5 and 5.0 times a rate at which the silane is flowed into the process chamber.

11. (Previously Presented) The method of claim 7 wherein the molecular nitrogen is flowed into the process chamber at a rate between 300 and 500 sccm.

12. (Currently Amended) The method of claim 1 further comprising maintaining a temperature within the process chamber while forming the ~~high contrast~~ silicate glass optical cores greater than 600°C.

13. (Currently Amended) The method of claim 1 wherein each of the ~~high contrast~~ silicate glass optical cores comprises a ~~high contrast~~ phosphorus doped silicate glass optical core or ~~high contrast~~ germanium doped silicate glass optical core.

14. (Canceled)

15. (Currently Amended) ~~The method of claim 1~~ A method of forming an optical waveguide, the method comprising:

flowing a silicon source gas into a process chamber;

flowing an oxygen source gas into the process chamber;

forming a high-density plasma in the process chamber from the silicon source gas and the oxygen source gas;

forming a plurality of separated silicate glass optical cores over an undercladding layer disposed within the process chamber with the high-density plasma, the separated silicate glass optical cores defining a sequence of gaps; and

depositing an uppercladding layer over the plurality of separated silicate glass optical cores,

wherein each of the silicate glass optical cores is formed with a refractive index greater than a refractive index of the undercladding layer such that each of the optical cores has a contrast relative to the undercladding layer greater than 2%;

wherein forming the plurality of ~~high contrast~~ optical cores comprises:

depositing a substantially continuous ~~high contrast~~ optical core layer on the undercladding layer with the high-density plasma; and

etching the sequence of gaps within the ~~high contrast~~ optical core layer to form the separated ~~high contrast~~ optical cores, and

wherein depositing the uppercladding layer comprises depositing the uppercladding layer within the gaps.

16. (Currently Amended) The method of claim 15 wherein forming the plurality of separated ~~high contrast~~ optical cores is performed without applying an RF bias to the undercladding layer.

17. (Withdrawn, Currently Amended) The method of claim 1 wherein forming the plurality of ~~high contrast~~ optical cores comprises:

etching a plurality of trenches in the undercladding layer; and

depositing ~~high contrast~~ silicate glass within each of the trenches with the high-density plasma.

18. (Withdrawn, Currently Amended) The method of claim 17 wherein depositing ~~high contrast~~ silicate glass within each of the trenches comprises applying an RF bias to the undercladding layer.

19. – 20. (Canceled).

21. (Currently Amended) The method of claim 1 further comprising annealing the plurality of ~~high contrast~~ optical cores.

22. (Currently Amended) The method of claim 1, further comprising:

flowing a dopant source gas into the process chamber; and

maintaining a pressure of less than 100 millitorr in the process chamber, wherein:

forming the high-density plasma comprises providing energy to the process chamber inductively with an RF power density greater than 3 Watts/cm^2 and forming the high-density plasma from the silicon gas source, the oxygen gas source, and the dopant gas source; and

the dopant source gas causes each of the plurality of ~~high contrast~~ optical cores to have a refractive index above 1.46.

23. (Previously Presented) The method of claim 22 wherein the oxygen source gas and silicon source gas are flowed to provide a ratio of oxygen atoms to silicon atoms is in the high-density plasma greater than 3:1.

24. (Currently Amended) The method of claim 22 wherein the dopant source gas is a nitrogen source gas, whereby the ~~high contrast~~ optical core comprises silicon, oxygen, and nitrogen.

25. (Original) The method of claim 24 wherein said nitrogen source gas is molecular nitrogen.

26. (Original) The method of claim 25 wherein the silicon source gas is silane.

27. (Previously Presented) The method of claim 26 wherein the molecular nitrogen is flowed into the process chamber at a rate between 0.5 and 5.0 times a rate at which the silane is flowed into the process chamber.

28. (Original) The method of claim 22 wherein the dopant source gas is a phosphorus containing gas or germanium containing gas.

29. (Currently Amended) A substrate processing system comprising:

a housing defining a process chamber;

a high-density plasma generating system operatively coupled to the process chamber;

a substrate holder configured to hold a substrate during substrate processing;

a gas-delivery system configured to introduce gases into the process chamber, including sources for a silicon-containing gas, an oxygen-containing gas, and a dopant-containing gas;

a pressure-control system for maintaining a selected pressure within the process chamber;

a controller for controlling the high-density plasma generating system, the gas-delivery system, and the pressure-control system; and

a memory coupled to the controller, the memory comprising a computer-readable medium having a computer-readable program embodied therein for directing operation of the substrate processing system to form an optical waveguide, the computer-readable program including:

instructions to flow a gaseous mixture containing flows of the silicon-containing gas, the oxygen-containing gas, and the dopant-containing gas into the process chamber;

instructions to maintain a pressure of less than 100 millitorr within the process chamber; and

instructions to form a high-density plasma in the process chamber from the gaseous mixture by providing energy to the process chamber inductively with an RF power density greater than 3 Watts/ cm^2;

instructions to form a plurality of separated ~~high contrast~~ silicate glass optical cores over an undercladding layer disposed within the process chamber with the high-density plasma, wherein:

the separated ~~high contrast~~ silicate glass optical cores define a sequence of gaps; and

the dopant-containing gas causes each of the plurality of ~~high contrast~~ optical cores to have a refractive index above 1.46 and greater than a refractive index of the undercladding layer <u>such that each of the optical cores has a contrast relative to the undercladding layer greater than 2%</u>; and

instructions to deposit an uppercladding layer over the plurality of separated ~~high contrast~~ silicate glass optical cores.

30. (Previously Presented) The substrate processing system of claim 29 wherein the instructions to flow the gaseous mixture include instructions to flow the oxygen-containing gas and the silicon-containing gas to provide a ratio of oxygen atoms to silicon atoms in the high-density plasma greater than 3:1.

31. (Currently Amended) The substrate processing system of claim 29 wherein the dopant-containing gas comprises a nitrogen-containing gas, whereby each of the plurality of ~~high contrast~~ optical cores comprises silicon, oxygen, and nitrogen.

32. (Original) The substrate processing system of claim 31 wherein the silicon-containing comprises silane and the nitrogen-containing gas includes molecular nitrogen.

33. (Previously Presented) The substrate processing system of claim 32 wherein the instructions to flow the gaseous mixture include instructions to flow the molecular nitrogen into the process chamber at a rate between 0.5 and 5.0 times a rate at which the silane is flowed into the process chamber.

34. (Currently Amended) The substrate processing system of claim 29 wherein the substrate holder comprises an electrostatic chuck, and wherein computer-readable program further includes instructions for turning the electrostatic chuck off during deposition of the plurality of ~~high contrast~~ silicate glass optical cores.

35. (Previously Presented) The substrate processing system of claim 29 further comprising a top RF source and a side RF source, wherein the instructions to form the high-density plasma include instructions to provide energy to the process chamber inductively with the top and side RF sources, with a ratio of power provided by the top RF source to power provided by the side RF source being between 0.21 and 0.73.

36. (Original) The substrate processing system of claim 29 wherein the dopant containing gas is a phosphorus containing gas or germanium containing gas.

37. (Currently Amended) A computer-readable storage medium having a computer-readable program embodied therein for directing operation of a substrate processing system including a process chamber; a plasma generation system; a substrate holder; and a gas delivery system configured to introduce gases into the process chamber, the computer-readable program including instructions for operating the substrate processing system to form an optical waveguide in accordance with the following:

flowing a silicon source gas into the process chamber;

flowing an oxygen source gas into the process chamber;

flowing a dopant source gas into the process chamber;

maintaining a pressure of less than 100 millitorr in the process chamber;

forming a high-density plasma in the process chamber from the silicon source gas, the oxygen source gas, and the dopant source gas by providing energy to the process chamber inductively with an RF power density greater than 3 Watts/cm^2;

forming a plurality of separated silicate glass optical cores over an undercladding layer disposed within the process chamber with the high-density plasma, wherein:

the separated ~~high contrast~~ silicate glass optical cores define a sequence of gaps; and

the dopant containing source causes each of the plurality of ~~high contrast~~ optical cores to have a refractive index above 1.46 and greater than a refractive index of the undercladding layer such that each of the optical cores has a contrast relative to the undercladding layer greater than 2%; and

depositing an uppercladding layer over the plurality of separated ~~high contrast~~ silicate glass optical cores.

38. (Previously Presented) The computer-readable storage medium of claim 37 wherein the oxygen source gas and silicon source gas are flowed to provide a ratio of oxygen atoms to silicon atoms in the high-density plasma greater than 3:1.

39. (Currently Amended) The computer-readable storage medium of claim 37 wherein the dopant source gas is a nitrogen source gas, whereby each of the plurality of ~~high contrast~~ optical cores comprises silicon, oxygen, and nitrogen.

40. (Original) The computer-readable storage medium of claim 39 wherein said nitrogen source gas is molecular nitrogen and the silicon source is silane.

41. (Previously Presented) The computer-readable storage medium of claim 40 wherein the molecular nitrogen is flowed into the process chamber at a rate between 0.5 and 5.0 times a rate at which the silane is flowed into the process chamber.

42. (Original) The computer-readable storage medium of claim 37 wherein the dopant source gas is a phosphorus containing gas or germanium containing gas.